Math 212, S05: Multi-Variable Calculus

Fall 2020

Instructor: William Worden
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Office: Herman Brown Hall 420
Classroom, time: Online/PCF4, MWF 2:45-3:40am
Course webpage: https://canvas.rice.edu/courses/33988

Office Hours: TUE 4:30–6pm, WED 1–2pm, FRI 8–10am. My posted office hours are time that I reserve for students—feel free to come without notice, and stay as long as you like. You may also email me to make an appointment to meet outside of office hours.

Piazza: This class will have a shared Piazza page with the other three sections of Math 212. This is an online forum for asking and answering questions. The instructors for Math 212 will monitor the forum and answer questions. Students can also answer other students' questions. You can sign up for Piazza here:

https://piazza.com/school-search

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Use the access code Math212F20 to access the course. Note that other than office hours, Piazza is the preferred method for asking question about course content (homework, concepts, etc.). When a new question appears, instructors will get email notifications, so there is no need to send a separate email about a question.

Calendar: A calendar for the course appears as the homepage of the course Canvas page (which is the course webpage). This calendar will contain links to everything you need for each day. This includes videos, worksheets, and even class notes.

Textbook: OpenStax Calculus Volume 3. This book is free and can be downloaded as a pdf here: https://tinyurl.com/yxqns33t.

Course Delivery: This course is dual-mode. The class will be split into two groups, Group A and Group B. On any given day, one group will attend class in person, and the other group will attend via Zoom. Students using Zoom may access the Zoom meeting via the link provided on the Zoom tab of their Canvas page. Sharing video on Zoom during class is strongly encouraged, but not required. I understand that some students do not have the ability to share video (i.e., a bad internet connection), and some students are just more comfortable not sharing. THE FIRST DAY OF CLASS WILL BE FULLY ONLINE, FOR ALL STUDENTS. Because this course is tightly scheduled, **it is important that everyone is logged on (or in the classroom) and ready by 2:45pm.**

Course Aims: The focus of this course is vector calculus, which concerns functions of several variables and functions whose values are vectors rather than just numbers. In this broader context, we will revisit notions like continuity, derivatives, and integrals, as well as their applications (such as finding minima and maxima). We'll explore new geometric objects such as vector fields, curves,

and surfaces in 3-space and study how these relate to differentiation and integration. The highlight of the course will be theorems of Green, Stokes, and Gauss, which relate seemingly disparate types of integrals in surprising ways, but are higher dimensional analogues of the Fundamental Theorem of Calculus.

For most people, vector calculus is the most challenging term in the calculus sequence. There are a larger number of interrelated concepts than before, and solving a single problem can require thinking about one concept or object in several different ways. Because of this, conceptual understanding is more important than ever, and it is not possible to learn a short list of problem templates in lecture that will allow you to do all the HW and exam problems. Thus, while lecture videos and class will include several worked examples, you will still often be asked to solve a HW problem that doesn't match up with one that you've already seen. The goal here is to get a solid understanding of vector calculus so you can solve any such problem you encounter in mathematics, the sciences, or engineering. That requires trying to solve new problems from first principles, if only because the real world is a complicated place!

In a typical day:

(1) Videos: Sometime before class, you will watch 2-4 short videos explaining some concepts. These videos will allow us to spend less time in class with lecture, and more time in group work.
(2) Start class: In the actual class, we will spend the first 5 or so minutes getting class started, then will break up into pre-assigned groups of 3-4.
(3) Group work: In your breakout room (or in class), you'll work with your group for about 15 minutes on a worksheet that will focus on developing your conceptual understanding of some of the topics covered in the videos.
(4) Short lecture: Following this first group exercise, we will reconvene for a 15-20 minute lecture on some new material that was not covered in the videos (or that we want to go into more depth with).
(5) Group work: After the short lecture, we will have another 15 minute group exercise, again guided by a worksheet. This will typically work on your understanding of the concepts covered in the short lecture.
(6) End of class: Ideally, we will have a few minutes to reflect briefly on the group exercise.

Videos: Much of the course material will be presented via pre-recorded videos. This will allow more of the class time to be spent working through the concepts, via group work. These videos were recorded for this class, some by myself, and some by the other instructors for Math 212. For each class day, there is a set of videos that should be watched BEFORE coming to class. It is VERY IMPORTANT that you watch these videos, so that you are prepared for what will be discussed in class.

Homework: The course will have both online and written homework. WebWork will be used for online homework, and may be accessed at

http://webwork.math.rice.edu/webwork2/Math212Fall20Worden/.

Initial login to WebWork can be done using your net ID as username and student ID as password. You should then change your password. Online homework will be assigned every day that we have class (with a few exceptions), and will be due at 8am two class periods later (so Monday's homework will be due at 8am on Friday morning). When working on WebWork assignments, you should work

your solutions on paper as you would if you were going to hand them in (i.e., neatly and showing all work), then enter the solutions online.

There will also be weekly written homework, assigned on Wednesday of each week and due the following Wednesday. For each of these assignments, solutions will need to be written up and handed in (see below instructions). No late homework will be accepted, except in the case of a documented emergency, or other rare exceptions at my discretion. However, the three lowest-scoring WebWork assignments will be dropped at the end of the semester, as will the two lowest-scoring written homework assignment. This policy is meant to account for minor illnesses or absences, though you are responsible for learning all material covered in homework assignments. Written homework assignments will be posted on Gradescope—see below for further details.

Gradescope: Written homework will be managed through Gradescope. I will add students to the course automatically using the Canvas roster, and you will receive an email with a link to login to the course. **Students who have not been automatically enrolled can self-enroll using the class code: MB65GD**. For instruction on using Gradescope to submit homework, see this PDF: https://tinyurl.com/y3wxdewr.

Working on homework with others: You are encouraged to work with your classmates on homework, with the following considerations. First, you should give serious thought to an exercise, and try to come to a solution by yourself, before discussing it with others. The purpose of collaboration is to help each other understand the concepts, think about the problem, and discuss approaches to reaching a solution. Your goal should be to come out of a collaboration with an understanding of how to do a certain type of problem, not just the particular problem you were assigned. Most importantly, you should always write up your solutions (or submit them to WebWork) on your own.

Whether working by yourself or with others, you should never look up solutions to problems online. Calculators will not be allowed for exams, and therefore you should not use them when working on homework (unless directed otherwise). It is your duty under the Honor Code, and in your own best interests as you prepare for exams, to follow the above guidelines.

Worksheets: Group work will be guided by worksheets, which will be available via link to a PDF on the course calendar. 5% of the course grade will be based on participation, and this will be evaluated based on effort put forth on the worksheets. For each day that there is a worksheet activity, your group should submit a completed worksheet to Gradescope. This will be due by midnight the same day (so Monday's worksheet will be due at 12am on Monday). The reason it is due the same day is that I want to you to just turn it in after class, whether it's done or not. You will not be penalized for an unfinished worksheet. Students taking the class asynchronously will need to complete the worksheet independently, or may meet with other asynchronous students to work on them. Students in GMT+ time zones will have an extra 12 hours to hand in the worksheets.

Exams: There will be two Midterm exams, and a Final exam. The first midterm will be on **Tuesday, September 29th** and the second will be on **Tuesday, October 27th**. Each exam will be 2 hours, and students may sign up for one of two time slots in which they can take the exam (one will be 6-8am, the other 7:30-9:30pm). The exams will be distributed via Gradescope, and students will upload solutions to Gradescope when their chosen 2 hour time window is done. More details regarding exam administration will be provided closer to the exam dates. **If you have**

a conflict with either of these dates, you are required to let me know by the end of the first week of class. Otherwise, only documented medical emergencies will be accepted as an excuse for missing an exam.

The time and day for the Final Exam will be determined by the Registrar's office and is not currently available. It is the policy of the Mathematics Department that no final may be given early to accommodate student travel plans. If you make travel plans that later turn out to conflict with the scheduled exam, then it is your responsibility to either reschedule your travel plans or take a zero on the final.

The exams are closed note, closed book, and use of a calculator or any other outside resource such as a computer, a website, or another person is prohibited. Any evidence of cheating will be promptly referred to the Honor Council.

Attendance: Attendance is not required, but it is encouraged for those who are able. No grade will be associated to attendance.

Grading: Online and written homework will together account for 20% of your grade. The three exams (Midterm 1/Midterm 2/Final) will be worth a total of 75% of your course grade, and will be weighted (4/4/5) or (3/4/6) or (4/3/6), whichever gives you the highest grade. The remaining 5% will be for participation, evaluated based on effort on the worksheets.

When computing final course grades, a student's exam scores are normalized against scores of all students in Math 212 this semester, not just those in this section.

Collegiality and Respect: The Department of Mathematics supports an inclusive learning environment where diversity and individual differences are understood, respected, and recognized as a source of strength. Racism, discrimination, harassment, and bullying will not be tolerated. We expect all participants in mathematics courses (students and faculty alike) to treat each other with courtesy and respect, and to adhere to the mathematics department standards of collegiality, respect, and sensitivity as well as the Rice Student Code of Conduct. If you think you have experienced or witnessed unprofessional or antagonistic behavior, then the matter should be brought to the attention of the instructor and/or department chair. The Ombudsperson is also available as an intermediate, informal option, and contacting them will not necessarily trigger a formal inquiry.

Title IX Responsible Employee Notification: Rice University cares about your wellbeing and safety. Rice encourages any student who has experienced an incident of harassment, pregnancy discrimination or gender discrimination or relationship, sexual, or other forms interpersonal violence to seek support through The SAFE Office. Students should be aware when seeking support on campus that most employees, including myself, as the instructor/TA, are required by Title IX to disclose all incidents of non-consensual interpersonal behaviors to Title IX professionals on campus who can act to support that student and meet their needs. For more information, please visit safe.rice.edu or email titleixsupport@rice.edu.

Disability Resources: If you have a documented disability that may affect academic performance, you should: 1) make sure this documentation is on file with Disability Resource Center (Allen Center, Room 111 / adarice@rice.edu / x5841) to determine the accommodations you need; and 2) contact me to discuss your accommodation needs and provide me with a copy of your Accommodation Letter.

Disclaimer: This syllabus is subject to change, though I will do my best to avoid this. Students will be notified of any changes as early as possible, and will be consulted for feedback as these decisions are made.